

Amendments to the Claims:

Claims 1-27 are pending in this application. Claims 1 and 27 are independent. Claims 5 and 6 are cancelled. Claims 1, 7, 8, 17, 20, 22, 24 and 27 are amended. Claims 28-35 are added.

This listing of claims will replace all prior versions, and listings, of claims in the application:

1 (CURRENTLY AMENDED): A color combining optical system for combining color light reflected by a dichroic film and color light transmitted through the dichroic film, wherein an optical thickness of the dichroic film increases or decreases from one end side to the other end side in an inclining direction of the dichroic film with respect to an incident optical axis of the color light reflected by the dichroic film,

wherein said optical system comprises a plurality of prisms cemented to one another and further comprises a positive refracting optical element which has a positive refractive power and causes the reflected color light to be incident on said color combining prism,

wherein said dichroic film is formed on an interface between two of the plurality of prisms.

2 (PREVIOUSLY PRESENTED): A system according to claim 1, wherein a thickness of the dichroic film increases or decreases from one end side to the other end side in the inclining direction.

3 (PREVIOUSLY PRESENTED): A system according to claim 1, wherein a refractive index of the dichroic film increases or decreases from one end side to the other end side in the inclining

direction.

4 (PREVIOUSLY PRESENTED): A system according to claim 1, wherein the optical thickness of the dichroic film increases as an incident angle of the reflected chromatic light on the dichroic film increases.

5-6 (CANCELLED):

7 (CURRENTLY AMENDED): A system according to claim 6 1, wherein said color combining prism is joined to said positive refracting optical system.

8 (CURRENTLY AMENDED): A system according to claim 6 1, wherein said color combining prism and said positive refracting optical element are integrally formed.

9 (ORIGINAL): A system according to claim 5, wherein said color combining prism incorporates two dichroic films for reflecting different color light beams, and an optical thickness of at least one of the two dichroic films increases or decreases from one end side to the other end side in the inclining direction.

10 (ORIGINAL): A system according to claim 9, wherein the two dichroic films are formed so as not to cross each other within said color combining prism.

11 (PREVIOUSLY PRESENTED): A system according to claim 9, wherein said color combining prism comprises three prisms.

12 (PREVIOUSLY PRESENTED): A system according to claim 9, wherein said color combining prism comprises four prisms.

13 (ORIGINAL): A system according to claim 12, wherein two prisms are arranged between two dichroic films.

14 (ORIGINAL): A system according to claim 5, wherein said color combining prism includes a plurality of prisms, and

a prism, of the plurality of prisms, which is located nearest to an exit side has at least three optically flat surfaces, and an exit surface also serves as a totally reflecting surface.

15 (ORIGINAL): A system according to claim 5, wherein said color combining prism sequentially includes, from an exit side,

a first prism having at least three optically flat surfaces, with an exit surface also serving as a totally reflecting surface,

a second prism having at least three optically smooth surfaces, and

a third prism having at least two optically smooth surfaces, and

two dichroic films which reflect different color light beams are arranged between

said respective prisms so as not to cross each other.

16 (ORIGINAL): A system according to claim 5, wherein said color combining prism sequentially includes, from an exit side,

 a first prism having at least three optically flat surfaces, with an exit surface also serving as a totally reflecting surface,

 a second prism having at least two optically smooth surfaces,

 a third prism having at least three optically smooth surfaces, and

 a fourth prism having at least two optically smooth surfaces,

 two dichroic films which reflect different color light beams are arranged between said first and second prisms and between said third and fourth prisms so as not to cross each other.

17 (CURRENTLY AMENDED): A system according to claim 6 1, wherein $0.07 < L/f < 0.35$ is satisfied, where L is a diagonal length of an image display portion of said image modulation means, and f is a focal length of said positive refracting optical element.

18 (ORIGINAL): A system according to claim 9, wherein an angle q1 defined by a surface of said color combining prism which is located on an exit side and on which a dichroic film is formed and an exit surface of said color combining prism satisfies

$$20^\circ < q1 < 35^\circ$$

19 (ORIGINAL): A system according to claim 9, wherein an angle q_2 defined by an exit surface of said color combining prism and a surface of said color combining prism which is located on an incident side and on which a dichroic film is formed satisfies

$$40^\circ < q_2 < 50^\circ$$

20 (CURRENTLY AMENDED): A system according to claim 6 1, wherein a focal length of at least one of said plurality of positive refracting optical elements is different from focal lengths of said remaining positive refracting optical elements.

21 (ORIGINAL): An image projection optical system comprising:
said color combining optical system defined by claim 1, which color-synthesizes a plurality of light beams from a plurality of image modulation means; and
a projection optical system for enlarging/projecting combined image light from said color combining optical system.

22 (CURRENTLY AMENDED): ~~A system according to claim 21~~ An image projection optical system comprising:

said color combining optical system defined by claim 1, which color-synthesizes a plurality of light beams from a plurality of image modulation means; and
a projection optical system for enlarging/projecting combined image light from said color combining optical system,

wherein $|Lin/L| > 4$ is satisfied, where Lin is a distance from an incident pupil of said entire overall image projection optical system including said projection optical system, said color combining prism, and said positive refracting optical element to a display portion of said image modulation means, and L is a diagonal length of the image display portion of said image modulation means.

23 (ORIGINAL): A projection type image display apparatus comprising:

 a color separation optical system for color-separating light from a light source into a plurality of color light beams;

 a plurality of image modulation means illuminated with the plurality of color light beams;

 said color combining optical system defined by claim 1, which color-combines a plurality of color light beams from said plurality of image modulation means; and

 a projection optical system for enlarging/projecting combined image light from said color combining optical system.

24 (CURRENTLY AMENDED): A projection type image display apparatus comprising:

 a color separation optical system for color-separating light from a light source into a plurality of color light beams;

 a plurality of image modulation means illuminated with the plurality of color light beams; and

said color combining optical system defined by claim 21 22, which color-combines a plurality of color light beams from said plurality of image modulation means and enlarges/projects the combined light.

25 (PREVIOUSLY PRESENTED): A system according to claim 10, wherein said color combining prism comprises three prisms.

26 (PREVIOUSLY PRESENTED): A system according to claim 10, wherein said color combining prism comprises four prisms.

27 (PREVIOUSLY PRESENTED): A dichroic prism comprising:
a plurality of prisms cemented to one another; and
a plurality of dichroic film films formed on an interface between two of the plurality of prisms,

wherein a thickness of at least one of said plurality of the dichroic film films changes along the interface a surface on which said at least one dichroic film is formed.

28 (NEW): A dichroic prism according to claim 27, wherein said plurality of dichroic films do not intersect one another in said dichroic prism.

29 (NEW): A dichroic prism according to claim 27, wherein a thickness of each of said

plurality of dichroic films changes in a surface on which the dichroic film is formed.

30 (NEW): An image display apparatus comprising:

a plurality of image display elements;

a dichroic prism defined in claim 27; and

a projection optical system for projecting light that was emitted from a light source and through said plurality of image display elements and said dichroic prism on a surface to be projected.

31 (NEW): An image display apparatus comprising:

a plurality of image display elements; and

a dichroic prism defined in claim 27 for combining color lights from said plurality of image display elements.

32 (NEW): An image display apparatus according to claim 31, wherein an angle $\theta 1$ defined by the dichroic film, of said plurality of dichroic films, which is located on an exit side and an exit surface of said dichroic prism satisfies

$$20^\circ < \theta 1 < 35^\circ.$$

33 (NEW): An image display apparatus according to claim 31, wherein an angle $\theta 2$ defined by the dichroic film, of said plurality of dichroic films, which is located on an incident side and

an exit surface of said dichroic prism satisfies

$$40^\circ < \theta 2 < 50^\circ.$$

34 (NEW): An image display apparatus according to claim 31 further comprising a plurality of lenses between said plurality of image display elements and said dichroic prism.

35 (NEW): An image display apparatus according to claim 31, wherein the number of said plurality of image display element is three, and three positive lenses are provided such that each positive lens is located between the corresponding image display element and said dichroic prism.

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Amendment dated October 15, 2003
Reply to Office Action of July 15, 2003
Docket No. 1232-4750

REMARKS

Applicants respectfully request reconsideration of this application in view of the foregoing amendment and following remarks.

Status of the Claims

Claims 1-27 are pending in this application. Claims 1 and 27 are independent. Claims 1-5, 9-16, 18, 19, 21 and 23-27 have been rejected. Claims 6-8, 17, 20 and 22 have been indicated as allowable if rewritten in independent form. Claim 5 has been objected to because of informalities. By this Amendment, claims 1, 7, 8, 17, 20, 22, 24 and 27 have been amended. New claims 28-35 have been added. No new matter has been added by this Amendment.

Objection

DRAWINGS

The Office Action indicates that the communication filed on 02/25/2003 does not include a proposed drawing correction required by the Office Action of 10/02/2002.

Applicants contacted the Examiner to inquire as to the status of Applicants' filing of formal drawing for Fig. 25 on 02/25/2003. The Examiner indicated that the formal drawing is in the file and needs not be resubmitted. Applicants respectfully request confirmation by the Examiner that the previously submitted drawing correction has been received.

CLAIMS

Claim 5 has been objected to because of typo in "prims" instead of --prisms--. Claim 5 has been cancelled by this Amendment rendering the objection moot.

Rejection under 35 U.S.C. §

In paragraph five (5) of the Office Action, claims 1, 2, 5, 9-16, 18, 19, 21 and 23-27 have been rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,456,447 to Sato ("Sato") in view of U.S. Patent No. 6,273,568 to Okuyama ("Okuyama").

The Examiner indicates that "Sato teaches the salient features of the present invention, except a dichroic film wherein the optical thickness increases and decreases from one end side to the other end side in a direction of the dichroic film with respect to an incident optical axis of the color light reflected by the dichroic film." The Examiner then cites Okuyama for the lacking features in Sato. In particular, the Examiner cites a portion of Okuyama (i.e., col. 13, lines 12-14) as disclosing the lacking features in Sato. The cited portion of Okuyama describes:

Further, the construction of the dichroic film of the dichroic mirror 13 may be made such that as shown in Fig. 24, the film thickness thereof is continuously decreased in a direction in which the angle of incidence ϵ becomes smaller ($\theta_1 \rightarrow \theta_2$) and that the deviation of the wavelength of the transmittance 50% by the angular deviation of the ray of light incident on the dichroic film does not occur. (Emphasis added)

The Examiner seems to believe that using the dichroic film of Okuyama as disclosed above in Sato's optical system would have been obvious.

As Applicants understand it, the inclined dichroic film of the present invention is formed on one of the surfaces of the dichroic prism, not on the surface of the dichroic mirror as taught in Okuyama as described above.

Claim 1 has been amended for further clarification. In particular, claim 1, as amended recites "wherein said optical system comprises a plurality of prisms cemented to one another and further comprises a positive refracting optical element which has a positive refractive power and

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causes the reflected color light to be incident on said color combining prism, wherein said dichroic film is formed on an interface between two of the plurality of prisms."

Claim 27 has been amended to recite "wherein a thickness of at least one of said plurality of dichroic films changes along a surface on which said at least one dichroic film is formed." An aspect of the present invention as featured in claim 27 is to enable a compact optical system.

Applicants believe that each of claims 1 and 27 as amended is neither anticipated by nor rendered obvious in view of Sato and Okuyama, either taken alone or in combination, for at least the reasons discussed above.

Reconsideration and withdrawal of the rejections of claims 1 and 27 under 35 U.S.C. §103(a) is respectfully requested.

Applicants have not individually addressed the rejections of the dependent claims because Applicants submit that the independent claims from which they respectively depend are in condition for allowance as set forth above. Applicants however reserve the right to address such rejections of the dependent claims should such be necessary.

Claims 28-35 have been added to recite the claimed invention in an alternative manner. Specifically, added claims 28-35 depend from claim 27 directly or indirectly. Claims 28-35 are accordingly believed to be allowable for at least similar reasons as for claim 27.

Applicants believe that the added claims are in condition for allowance and such action is respectfully requested.

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AUTHORIZATION

No petitions or additional fees are believed due for this amendment and/or any accompanying submissions. However, to the extent that any additional fees and/or petition is required, including a petition for extension of time, Applicant hereby petitions the Commissioner to grant such petition, and hereby authorizes the Commissioner to charge any additional fees, including any fees which may be required for such petition, or credit any overpayment to Deposit Account No. 13-4500 (Order No. 1232-4750). **A DUPLICATE COPY OF THIS SHEET IS ENCLOSED.**

An early and favorable examination on the merits is respectfully requested.

Respectfully submitted,
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